

FCC Test Report

Product Name	Logistics Monitoring Tag
Model No.	GWS-CSCG Tag
FCC ID.	WL6GWS-CSCGTAG

Applicant	ELITEGROUP COMPUTER SYSTEMS CO., LTD
Address	No. 239, SEC. 2, TI DING BLVD, TAIPEI 11493, TAIWAN

Date of Receipt	Sep. 12, 2017
Issued Date	Oct. 13, 2017
Report No.	1790144R-RFUSP24V00
Report Version	V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

This report must not be used to claim product endorsement by TAF or any agency of the government.

The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.

Test Report

Issued Date: Oct. 13, 2017

Report No.: 1790144R-RFUSP24V00



Product Name	Logistics Monitoring Tag
Applicant	ELITEGROUP COMPUTER SYSTEMS CO., LTD
Address	No. 239, SEC. 2, TI DING BLVD, TAIPEI 11493, TAIWAN
Manufacturer	Golden Elite Technology (SHENZHEN) CO., LTD.
Model No.	GWS-CSCG Tag
FCC ID.	WL6GWS-CSCGTAG
EUT Rated Voltage	DC 3.3V(Power by battery)
EUT Test Voltage	DC 3.3V (Power by battery)
Trade Name	ECS
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2016 ANSI C63.4: 2014, ANSI C63.10: 2013 KDB 558074 D01 DTS Meas Guidance v04
Test Result	Complied

Documented By : Genie Chang
(Senior Adm. Specialist / Genie Chang)

Tested By : Kevin Liu
(Engineer / Kevin Liu)

Approved By : Vincent Lin
(Director / Vincent Lin)

TABLE OF CONTENTS

Description	Page
1. GENERAL INFORMATION	4
1.1. EUT Description.....	4
1.2. Operational Description.....	5
1.3. Tested System Details.....	6
1.4. Configuration of Tested System	6
1.5. EUT Exercise Software	6
1.6. Test Facility	7
1.7. List of Test Equipment.....	8
2. CONDUCTED EMISSION	9
2.1. Test Setup	9
2.2. Limits.....	9
2.3. Test Procedure	10
2.4. Uncertainty	10
2.5. Test Result of Conducted Emission	11
3. PEAK POWER OUTPUT	12
3.1. Test Setup	12
3.2. Limit	12
3.3. Test Procedure	12
3.4. Uncertainty	12
3.5. Test Result of Peak Power Output	13
4. RADIATED EMISSION	14
4.1. Test Setup	14
4.2. Limits.....	15
4.3. Test Procedure	16
4.4. Uncertainty	17
4.5. Test Result of Radiated Emission	18
5. RF ANTENNA CONDUCTED TEST	22
5.1. Test Setup	22
5.2. Limits.....	22
5.3. Test Procedure	22
5.4. Uncertainty	22
5.5. Test Result of RF Antenna Conducted Test	23
6. BAND EDGE	24
6.1. Test Setup	24
6.2. Limit	25
6.3. Test Procedure	25
6.4. Uncertainty	26
6.5. Test Result of Band Edge	27
7. 6DB BANDWIDTH	31
7.1. Test Setup	31
7.2. Limits.....	31
7.3. Test Procedure	31
7.4. Uncertainty	31
7.5. Test Result of 6dB Bandwidth.....	32
8. POWER DENSITY	35
8.1. Test Setup	35
8.2. Limits.....	35
8.3. Test Procedure	35
8.4. Uncertainty	35
8.5. Test Result of Power Density	36
9. DUTY CYCLE	39
9.1. Test Setup	39
9.2. Test Procedure	39
9.3. Uncertainty	39
9.4. Test Result of Duty Cycle.....	40
10. EMI REDUCTION METHOD DURING COMPLIANCE TESTING	41
Attachment 1: EUT Test Photographs	
Attachment 2: EUT Detailed Photographs	

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Logistics Monitoring Tag
Trade Name	ECS
Model No.	GWS-CSCG Tag
FCC ID.	WL6GWS-CSCGTAG
Frequency Range	2405 – 2480MHz
Channel Number	16CH
Type of Modulation	GFSK
Antenna Type	Chip antenna
Channel Control	Auto
Antenna Gain	Refer to the table “Antenna List”

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	Pulse larsen antennas	W3008GI	Chip antenna	1dBi

Note: The antenna of EUT is conforming to FCC 15.203.

Center Frequency of Each Channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 01	2405	Channel 05	2425	Channel 09	2445	Channel 13	2465
Channel 02	2410	Channel 06	2430	Channel 10	2450	Channel 14	2470
Channel 03	2415	Channel 07	2435	Channel 11	2455	Channel 15	2475
Channel 04	2420	Channel 08	2440	Channel 12	2460	Channel 16	2480

Note:

1. The EUT is a Logistics Monitoring Tag with a built-in 2.4GHz transmitter & a passive NFC tag.
2. These tests were conducted on a sample for the purpose of demonstrating compliance of 2.4GHz transmitter with Part 15 Subpart C Paragraph 15.247 for spread spectrum devices.
3. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.

Test Mode	Mode 1: Transmit
-----------	------------------

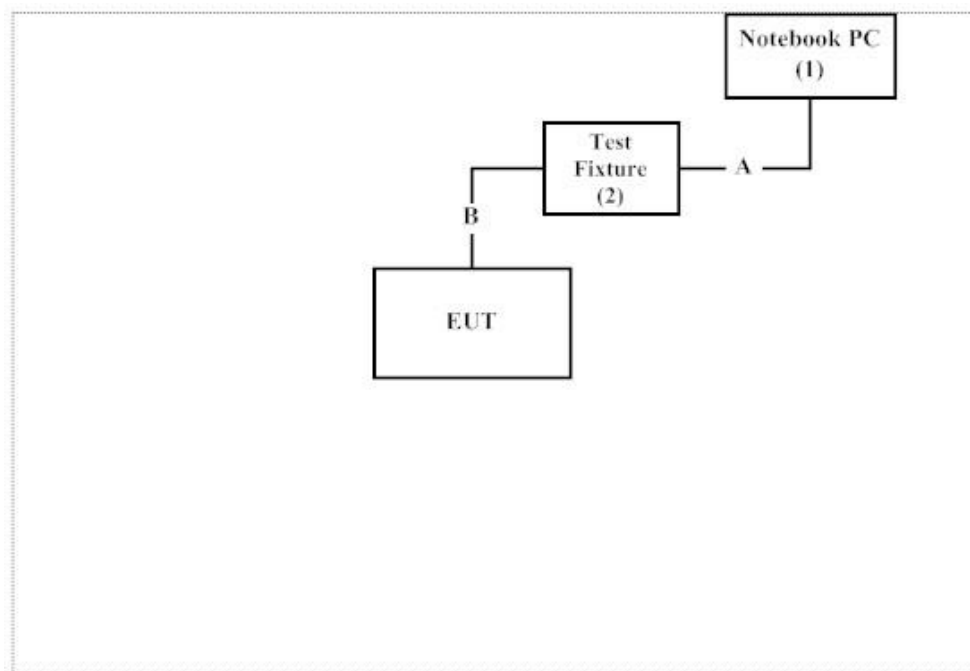
1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 Notebook PC	DELL	P62G	229FJC2	N/A
2 Test Fixture	ELITEGROUP	CIT53A20-V2.0	N/A	N/A

Signal Cable Type		Signal cable Description
A	Mini USB Cable	Shielded, 1.8m
B	Signal Cable	Non-Shielded, 0.3m

1.4. Configuration of Tested System



1.5. EUT Exercise Software

- (1) Setup the EUT and peripherals as shown in Section 1.4.
- (2) Execute “wtcdb V1.5” on the Notebook.
- (3) Configure the test mode, the test channel, and the data rate to start the continuous receive
- (4) Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:

<http://www.dekra.com.tw/english/about/certificates.aspx?bval=5>

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: http://www.dekra.com.tw/index_en

Site Description: Accredited by TAF
Accredited Number: 3023

Site Name: DEKRA Testing and Certification Co., Ltd.
Site Address: No.159, Sec. 2, Wenhua 1st Rd., Linkou Dist.,
New Taipei City 24457, Taiwan.
TEL: 886-2-2602-7968 / FAX : 866-2-2602-3286
E-Mail : info.tw@dekra.com

FCC Accreditation Number: TW3023

1.7. List of Test Equipment

For Conduction measurements /ASR1

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
	EMI Test Receiver	R&S	ESR7	101601	2017.01.06	2018.01.05
	Two-Line V-Network	R&S	ENV216	101306	2017.02.16	2018.02.15
	Two-Line V-Network	R&S	ENV216	101307	2017.03.17	2018.03.16
	Coaxial Cable	Quietek	RG400_BNC	RF001	2017.05.24	2018.05.23

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek EMI 2.0 V2.1.113

For Conducted measurements /ASR4

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Spectrum Analyzer	R&S	FSV30	103464	2017.01.09	2018.01.08
X	Power Meter	Anritsu	ML2496A	1548003	2016.12.15	2017.12.14
X	Power Sensor	Anritsu	MA2411B	1531024	2016.12.15	2017.12.14
X	Power Sensor	Anritsu	MA2411B	1531025	2016.12.15	2017.12.14
	Bluetooth Tester	R&S	CBT	101238	2017.01.03	2018.01.02

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek Conduction Test System V8.0.110

For Radiated measurements /ACB1

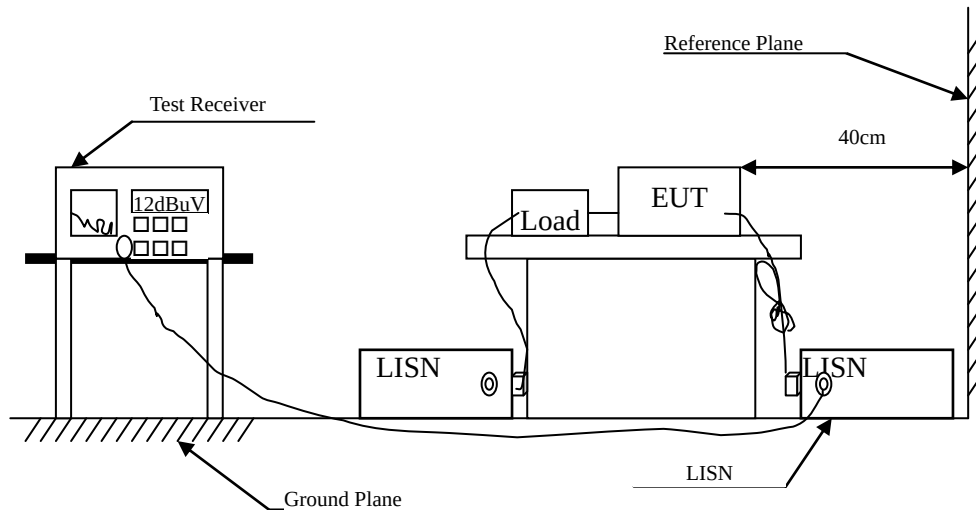
	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Loop Antenna	A.H.	SAS-562B	272	2016.07.21	2017.07.20
X	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-674	2017.02.09	2018.02.08
X	Horn Antenna	ETS-Lindgren	3117	00203800	2016.10.13	2017.10.12
X	Horn Antenna	Com-Power	AH-840	101087	2017.05.24	2018.05.23
X	Pre-Amplifier	EMCI	EMC001330	980316	2017.05.14	2018.05.15
X	Pre-Amplifier	EMCI	EMC051835SE	980311	2017.05.15	2018.05.16
X	Pre-Amplifier	EMCI	EMC05820SE	980310	2017.05.15	2018.05.16
X	Pre-Amplifier	EMCI	EMC184045SE	980314	2017.05.17	2018.05.18
X	Filter	MICRO TRONICS	BRM50702	G249	2017.08.11	2018.08.10
	Filter	MICRO TRONICS	BRM50716	G187	2017.08.16	2018.08.15
X	EMI Test Receiver	R&S	ESR7	101602	2016.12.15	2017.12.14
X	Spectrum Analyzer	R&S	FSV40	101149	2017.01.24	2018.01.23
X	Coaxial Cable	SUHNER	SUCOFLEX 106	RF002	2017.05.25	2018.05.24
X	Mircoflex Cable	HUBER SUHNER	SUCOFLEX 102	MY3381/2	2017.08.11	2018.08.10

Note:

1. Loop Antenna is calibrated every two year, the other equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek EMI 2.0 V2.1.113

2. Conducted Emission

2.1. Test Setup



2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

2.3. Test Procedure

The EUT and Peripherals are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

The EUT was setup to ANSI C63.4, 2014; tested to DTS test procedure of FCC KDB-558074 for compliance to FCC 47CFR Subpart C requirements.

2.4. Uncertainty

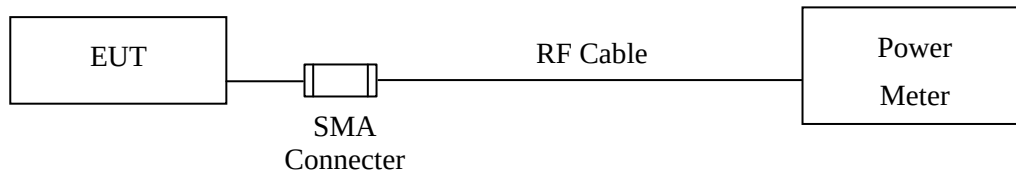
$\pm 2.35\text{dB}$

2.5. Test Result of Conducted Emission

Owing to the EUT use battery supply voltage, this test item is not performed.

3. Peak Power Output

3.1. Test Setup



3.2. Limit

The maximum peak power shall be less 1Watt.

3.3. Test Procedure

Tested according to DTS test procedure of KDB 558074 for compliance to FCC 47CFR 15.247 requirements. The maximum peak conducted output power using KDB 558074 section 9.1.3 PKPM1 Peak power meter method.

3.4. Uncertainty

± 0.86 dB

3.5. Test Result of Peak Power Output

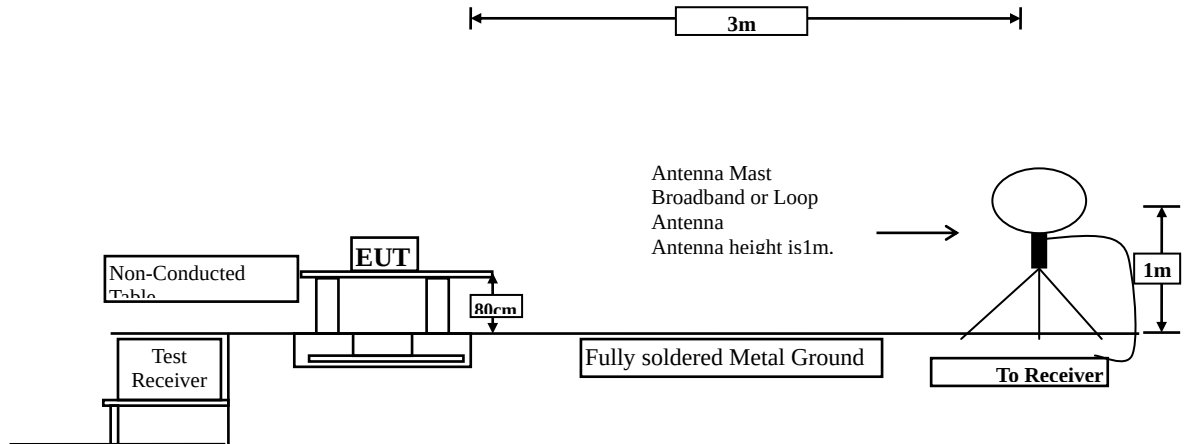
Product : Logistics Monitoring Tag
Test Item : Peak Power Output
Test Mode : Mode 1: Transmit
Test Date : 2017/10/11

Channel No.	Frequency (MHz)	Measurement (dBm)	Required Limit	Result
Channel 01	2405.00	4.15	1 Watt= 30 dBm	Pass
Channel 08	2440.00	4.63	1 Watt= 30 dBm	Pass
Channel 16	2480.00	5.04	1 Watt= 30 dBm	Pass

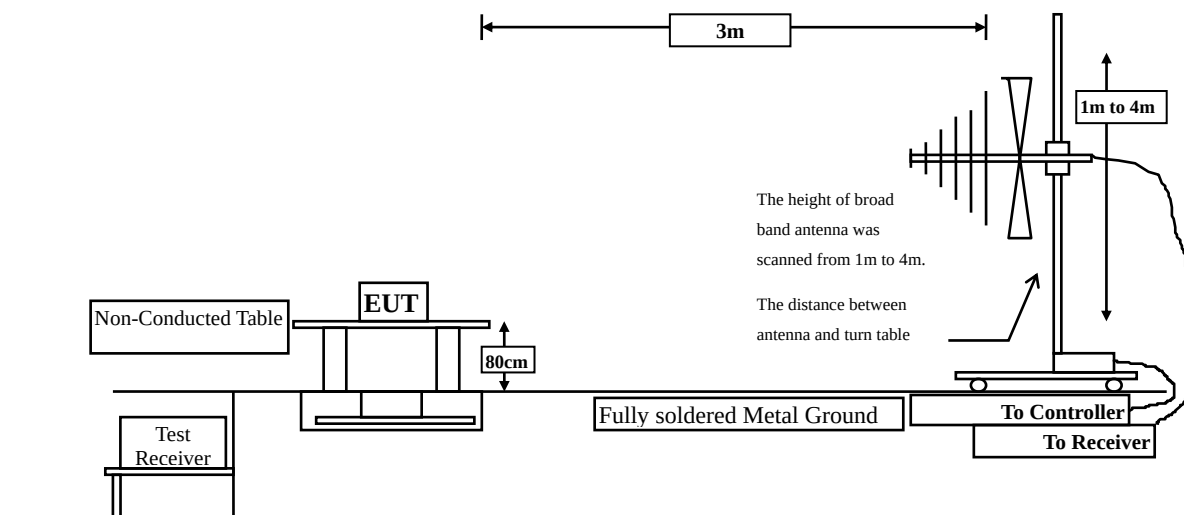
4. Radiated Emission

4.1. Test Setup

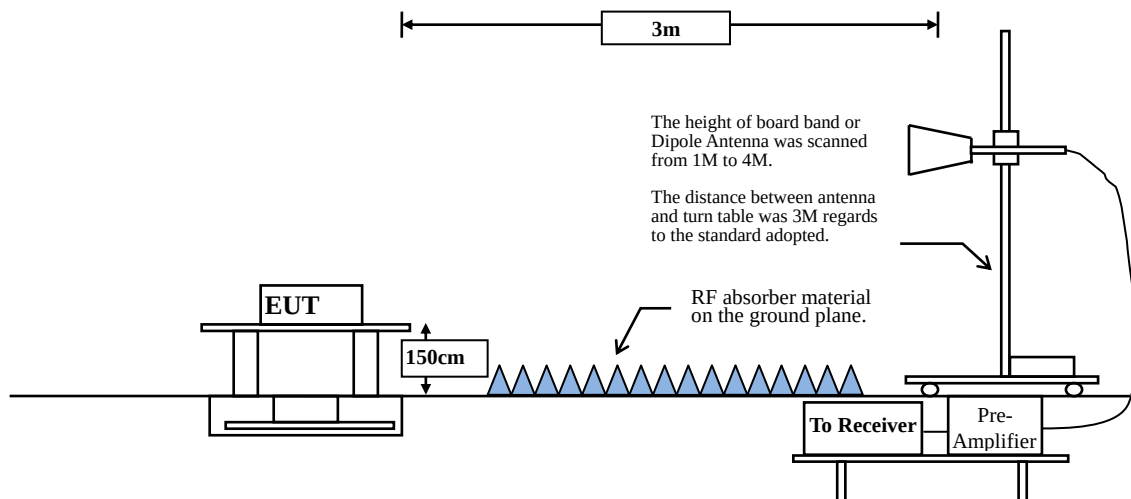
Radiated Emission Under 30MHz



Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



4.2. Limits

➤ General Radiated Emission Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

- Remarks:
1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
 2. In the Above Table, the tighter limit applies at the band edges.
 3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

4.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Measuring the frequency range below 1GHz, the EUT is placed on a turn table which is 0.8 meter above ground, when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2013 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna. The measurement frequency range from 9kHz - 10th Harmonic of fundamental was investigated.

RBW and VBW Parameter setting:

According to KDB 558074 section 12.2.4. Peak power measurement procedure

RBW = as specified in Table 1.

$VBW \geq 3 \times RBW$.

Table 1 —RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

According to KDB 558074 section 12.2.5. Average power measurement procedure

RBW = 1MHz.

VBW = 10Hz, when duty cycle $\geq 98\%$

$VBW \geq 1/T$, when duty cycle $< 98\%$

(T refers to the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.)

2.4GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
802.15.4	100	--	--	10

Note: Duty Cycle Refer to Section 9

4.4. Uncertainty

Horizontal polarization :

30-300MHz: $\pm 4.08\text{dB}$; 300M-1GHz: $\pm 3.86\text{dB}$; 1-18GHz: $\pm 3.77\text{dB}$; 18-40GHz: $\pm 3.98\text{dB}$

Vertical polarization :

30-300MHz: $\pm 4.81\text{dB}$; 300M-1GHz: $\pm 3.87\text{dB}$; 1-18GHz : $\pm 3.83\text{dB}$; 18-40GHz: $\pm 3.98\text{dB}$

4.5. Test Result of Radiated Emission

Product : Logistics Monitoring Tag
 Test Item : Harmonic Radiated Emission
 Test Mode : Mode 1: Transmit(2405MHz)
 Test Date : 2017/10/06

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level	dB	dBuV/m
	dB	dBuV	dBuV/m		
Horizontal					
Peak Detector:					
4810.000	-2.870	53.050	50.180	-23.820	74.000
7215.000	0.383	44.770	45.153	-28.847	74.000
9620.000	2.361	43.800	46.161	-27.839	74.000
Average					
Detector:					
--					54.000
Vertical					
Peak Detector:					
4810.000	-2.870	51.900	49.030	-24.970	74.000
7215.000	0.383	44.420	44.803	-29.197	74.000
9620.000	2.361	42.630	44.991	-29.009	74.000
Average					
Detector:					
--					54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Logistics Monitoring Tag
 Test Item : Harmonic Radiated Emission
 Test Mode : Mode 1: Transmit (2440MHz)
 Test Date : 2017/10/06

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
4880.000	-2.817	51.160	48.342	-25.658	74.000
7320.000	0.464	44.270	44.734	-29.266	74.000
9760.000	2.608	43.640	46.247	-27.753	74.000
Average					
Detector:					
--					54.000
Vertical					
Peak Detector:					
4880.000	-2.817	51.360	48.542	-25.458	74.000
7320.000	0.464	44.930	45.394	-28.606	74.000
9760.000	2.608	44.520	47.127	-26.873	74.000
Average					
Detector:					
--					54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Logistics Monitoring Tag
 Test Item : Harmonic Radiated Emission
 Test Mode : Mode 1: Transmit (2480MHz)
 Test Date : 2017/10/06

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
4960.000	-2.791	53.160	50.369	-23.631	74.000
7440.000	0.499	43.970	44.469	-29.531	74.000
9920.000	2.917	42.600	45.517	-28.483	74.000
Average					
Detector:					
--					54.000
Vertical					
Peak Detector:					
4960.000	-2.791	52.110	49.319	-24.681	74.000
7440.000	0.499	43.760	44.259	-29.741	74.000
9920.000	2.917	43.710	46.627	-27.373	74.000
Average					
Detector:					
--					54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Logistics Monitoring Tag
 Test Item : General Radiated Emission
 Test Mode : Mode 1: Transmit (2440MHz)
 Test Date : 2017/10/07

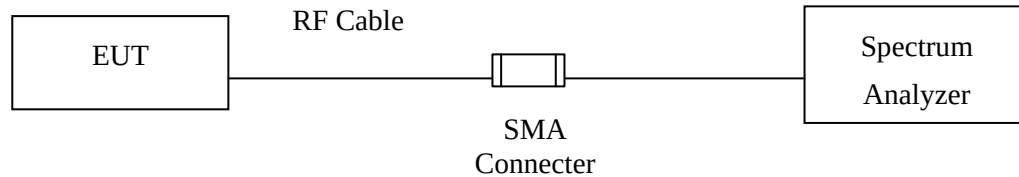
Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
119.971	-13.428	44.703	31.275	-12.225	43.500
299.913	-10.364	38.080	27.716	-18.284	46.000
492.507	-6.146	32.453	26.307	-19.693	46.000
612.000	-3.983	35.473	31.491	-14.509	46.000
756.797	-2.035	33.842	31.807	-14.193	46.000
852.391	-0.935	36.195	35.260	-10.740	46.000
Vertical					
93.261	-17.107	51.894	34.787	-8.713	43.500
360.362	-8.975	36.713	27.738	-18.262	46.000
595.130	-4.171	30.401	26.230	-19.770	46.000
699.159	-3.064	32.112	29.048	-16.952	46.000
813.029	-1.522	30.916	29.395	-16.605	46.000
883.319	-0.536	31.058	30.522	-15.478	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The emission levels of other frequencies are very lower than the limit and not show in test report.
5. No emission found between lowest internal used/generated frequency to 30MHz.

5. RF Antenna Conducted Test

5.1. Test Setup



5.2. Limits

According to FCC Section 15.247(d). In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

5.3. Test Procedure

The EUT was tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Set VBW > RBW, scan up through 10th harmonic.

5.4. Uncertainty

±1.23dB

5.5. Test Result of RF Antenna Conducted Test

Product : Logistics Monitoring Tag
Test Item : RF Antenna Conducted Test
Test Mode : Mode 1: Transmit
Test Date : 2017/09/22

Figure Channel 01:

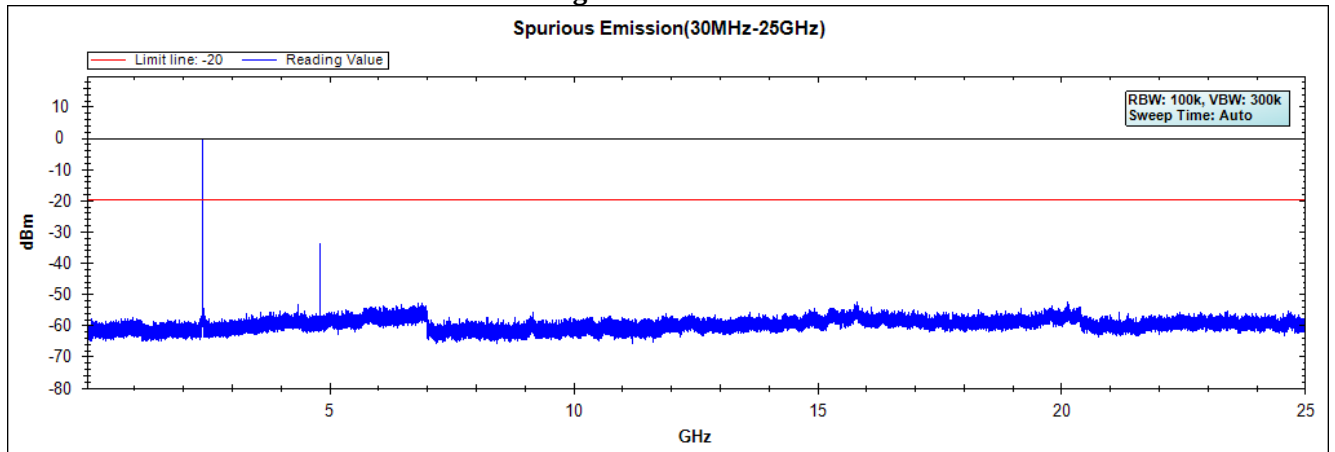


Figure Channel 08:

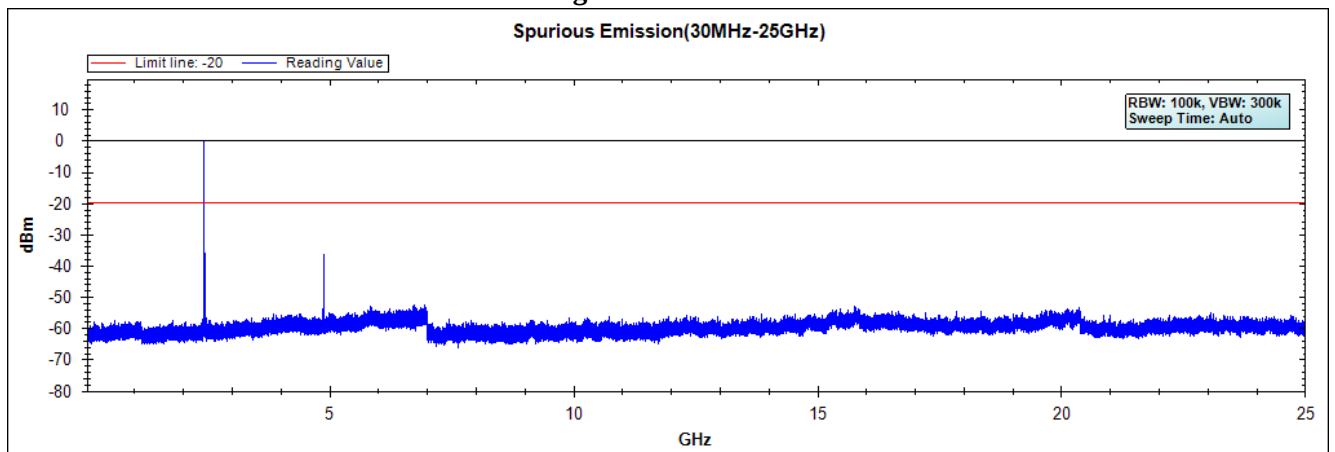
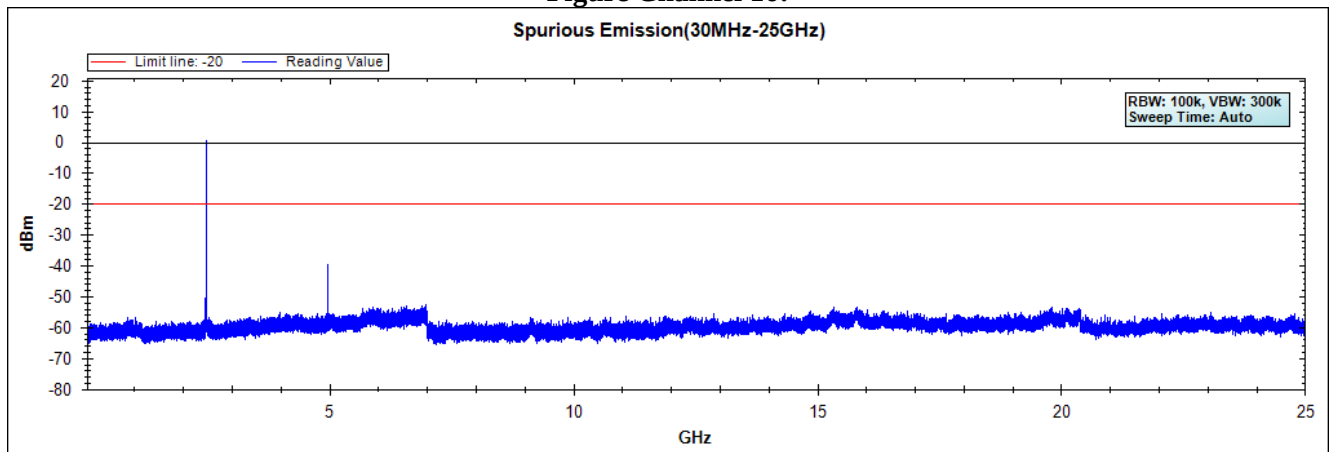


Figure Channel 16:

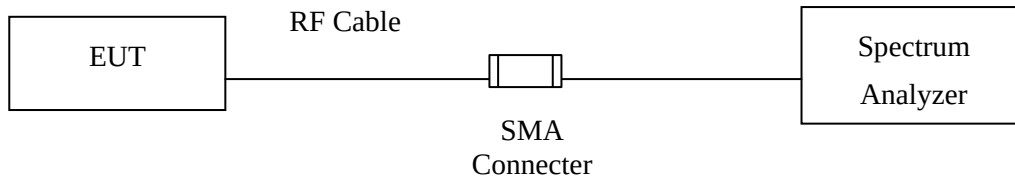


Note: The above test pattern is synthesized by multiple of the frequency range.

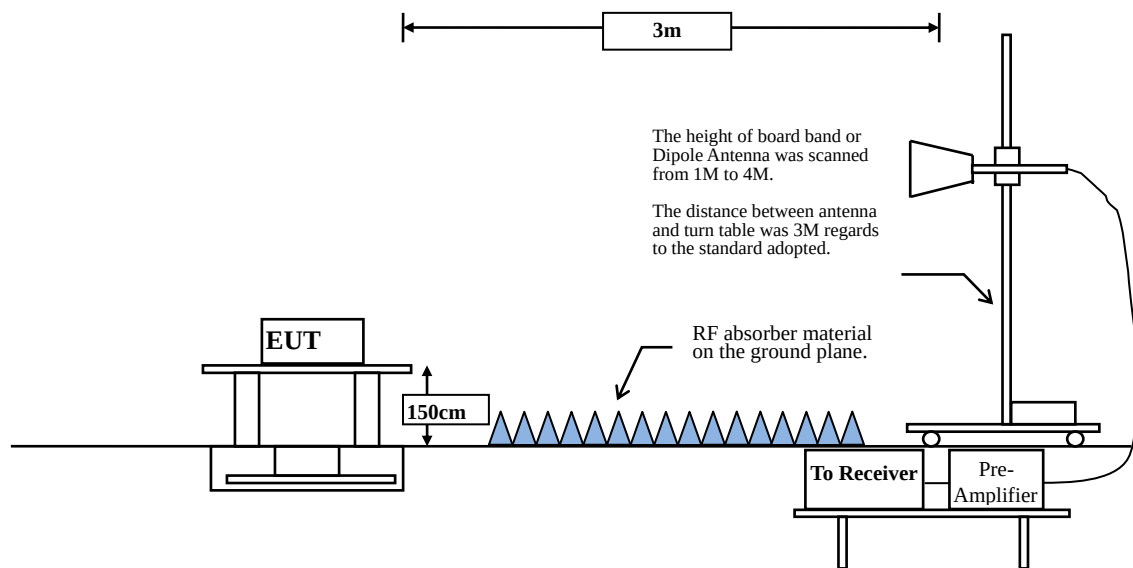
6. Band Edge

6.1. Test Setup

RF Conducted Measurement



RF Radiated Measurement:



6.2. Limit

According to FCC Section 15.247(d). In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.

RBW and VBW Parameter setting:

According to KDB 558074 section 12.2.4. Peak power measurement procedure

RBW = as specified in Table 1.

$VBW \geq 3 \times RBW$.

Table 1 —RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

According to KDB 558074 section 12.2.5. Average power measurement procedure

RBW = 1MHz.

VBW = 10Hz, when duty cycle $\geq 98\%$

$VBW \geq 1/T$, when duty cycle $< 98\%$

(T refers to the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.)

2.4GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
802.15.4	100	--	--	10

Note: Duty Cycle Refer to Section 9

6.4. Uncertainty

Conducted: $\pm 1.23\text{dB}$

Radiated:

Horizontal polarization : 1-18GHz: $\pm 3.77\text{dB}$

Vertical polarization : 1-18GHz : $\pm 3.83\text{dB}$

6.5. Test Result of Band Edge

Product : Logistics Monitoring Tag
 Test Item : Band Edge
 Test Mode : Mode 1: Transmit
 Test Date : 2017/10/05

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
01 (Peak)	2389.275	12.146	29.746	41.892	74.00	54.00	Pass
01 (Peak)	2390.000	12.148	28.429	40.577	74.00	54.00	Pass
01 (Peak)	2400.000	12.176	37.779	49.955	--	--	--
01 (Peak)	2404.638	12.186	75.378	87.565	--	--	--
01 (Average)	2390.000	12.148	16.661	28.809	74.00	54.00	Pass
01 (Average)	2400.000	12.176	27.339	39.515	74.00	54.00	Pass
01 (Average)	2405.073	12.188	73.122	85.310	--	--	--

Figure Channel 11: Horizontal (Peak)

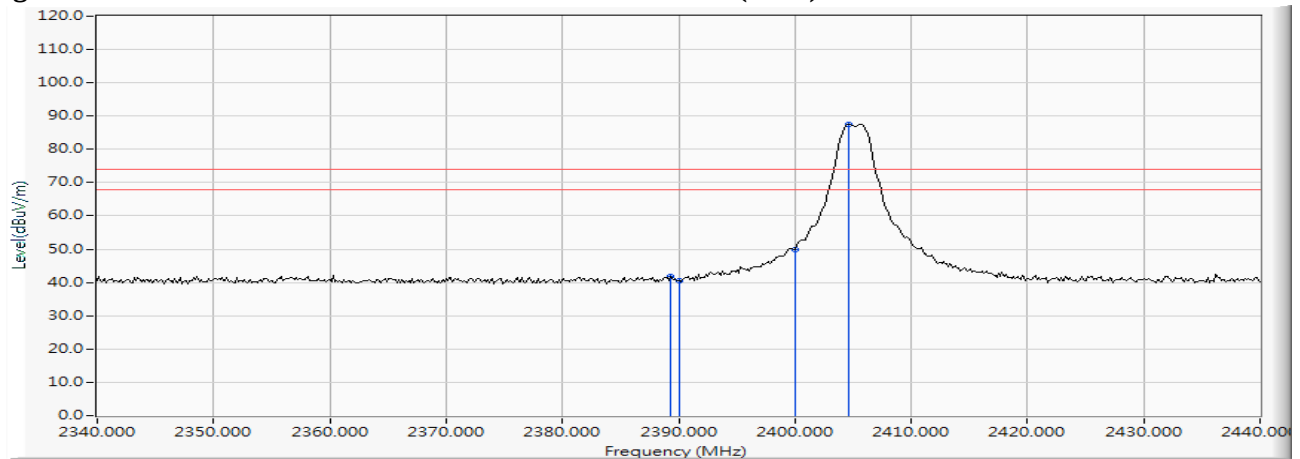
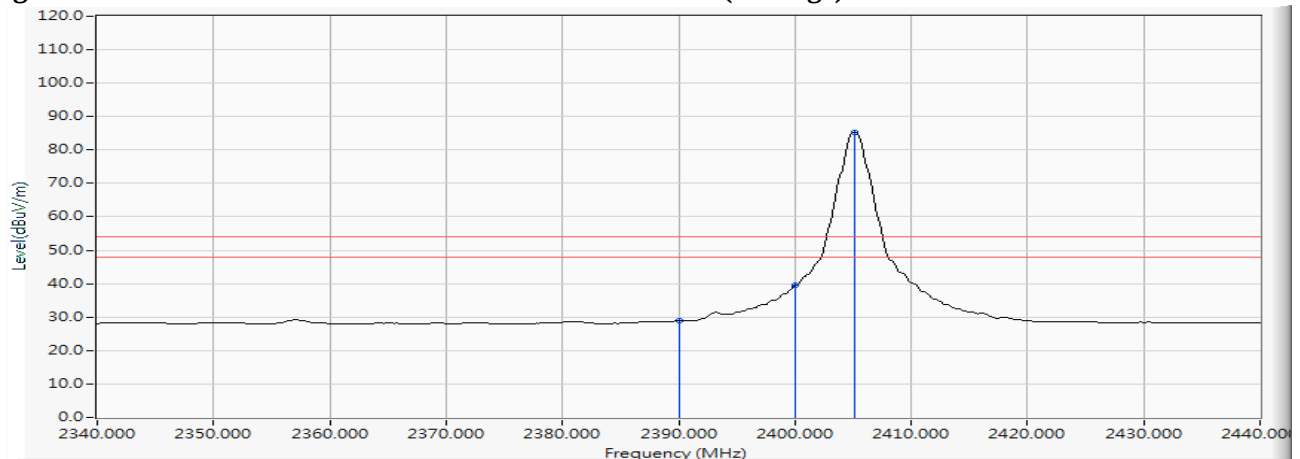


Figure Channel 11: Horizontal (Average)



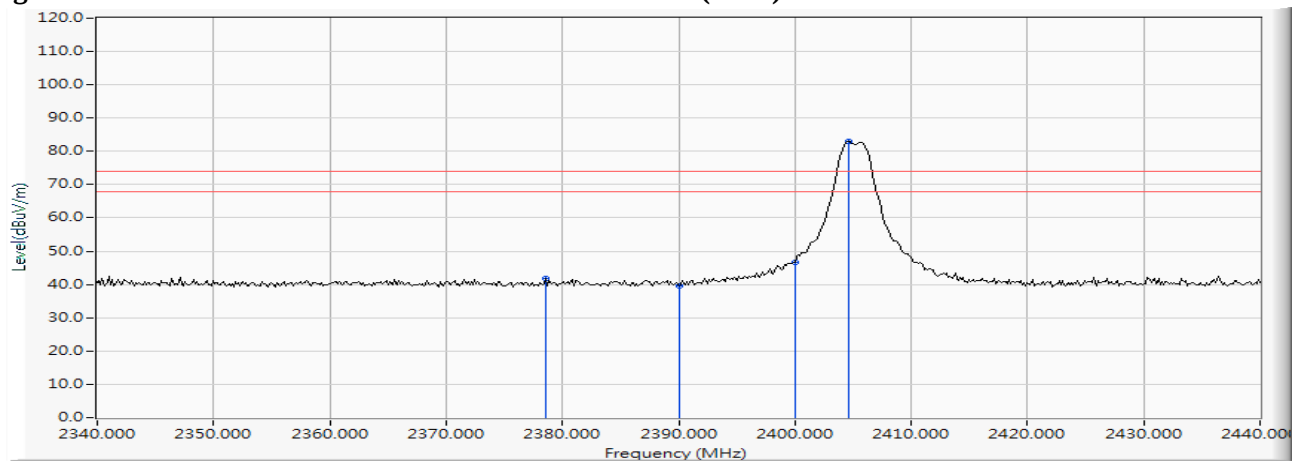
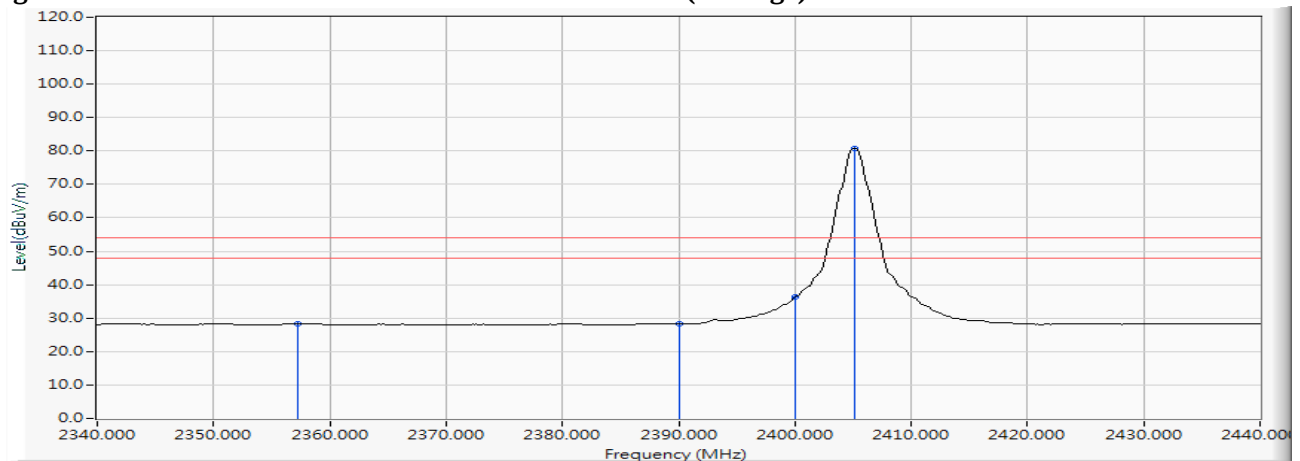
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Logistics Monitoring Tag
 Test Item : Band Edge
 Test Mode : Mode 1: Transmit
 Test Date : 2017/10/05

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
01 (Peak)	2378.551	12.115	29.822	41.937	74.00	54.00	Pass
01 (Peak)	2390.000	12.148	27.422	39.570	74.00	54.00	Pass
01 (Peak)	2400.000	12.176	34.562	46.738	--	--	--
01 (Peak)	2404.638	12.186	70.796	82.983	--	--	--
01 (Average)	2357.246	12.055	16.357	28.412	74.00	54.00	Pass
01 (Average)	2390.000	12.148	16.112	28.260	74.00	54.00	Pass
01 (Average)	2400.000	12.176	24.184	36.360	--	--	--
01 (Average)	2405.073	12.188	68.439	80.627	--	--	--

Figure Channel 11: Vertical (Peak)

Figure Channel 11: Vertical (Average)


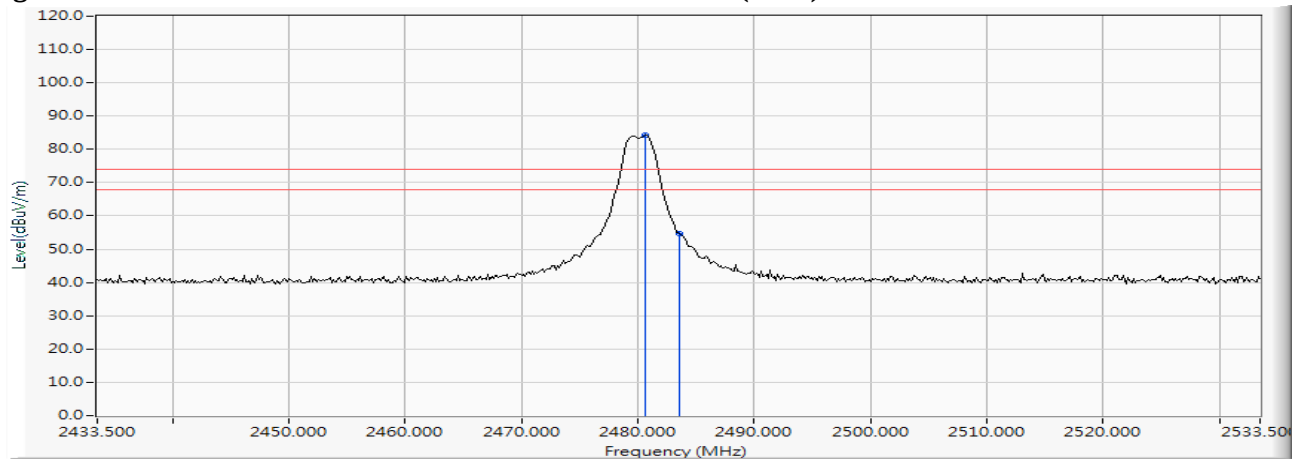
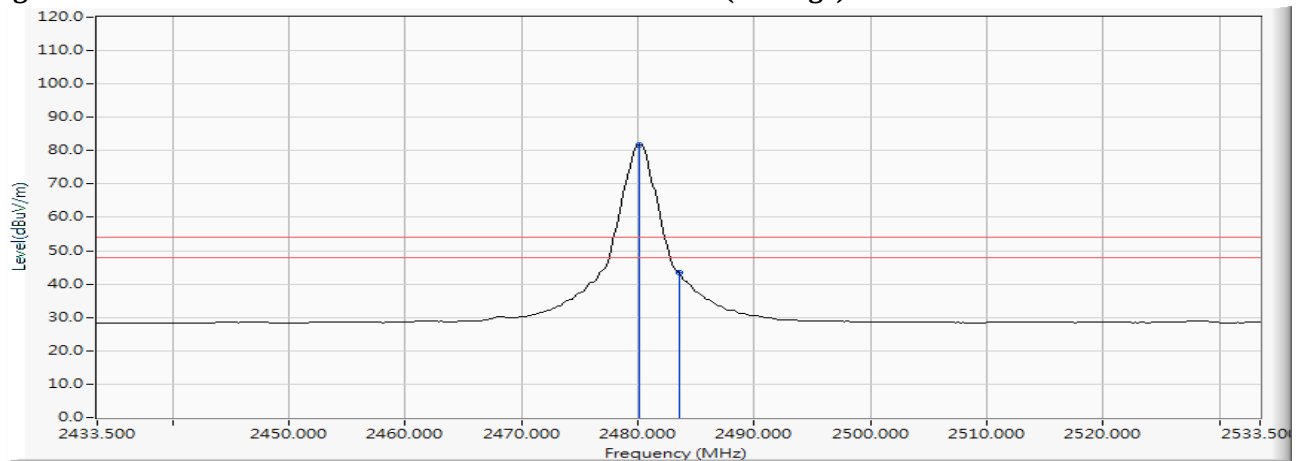
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Logistics Monitoring Tag
 Test Item : Band Edge
 Test Mode : Mode 1: Transmit
 Test Date : 2017/10/05

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
16 (Peak)	2480.602	12.394	71.853	84.248	--	--	--
16 (Peak)	2483.500	12.403	42.200	54.603	74.00	54.00	Pass
16 (Average)	2480.167	12.394	69.388	81.781	--	--	--
16 (Average)	2483.500	12.403	31.122	43.525	74.00	54.00	Pass

Figure Channel 26:
Horizontal (Peak)

Figure Channel 26:
Horizontal (Average)


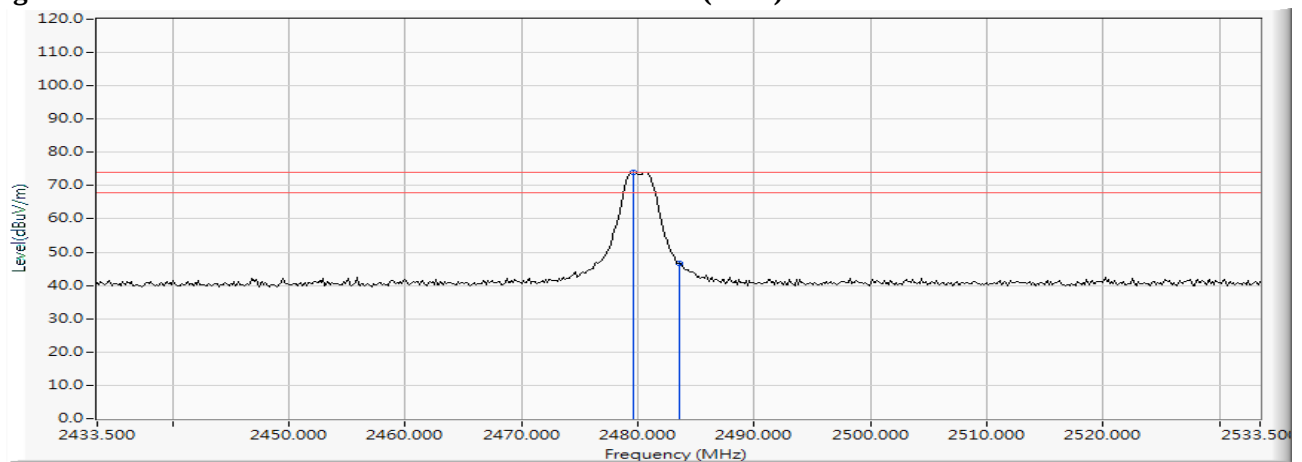
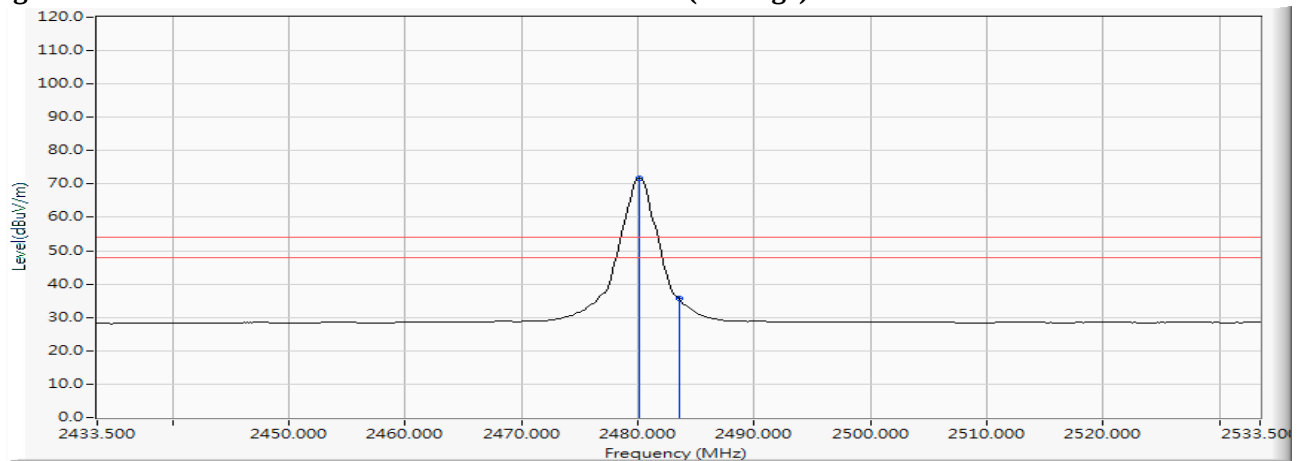
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Logistics Monitoring Tag
 Test Item : Band Edge
 Test Mode : Mode 1: Transmit
 Test Date : 2017/10/05

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
16 (Peak)	2479.587	12.392	61.733	74.125	--	--	--
16 (Peak)	2483.500	12.403	34.371	46.774	74.00	54.00	Pass
16 (Average)	2480.167	12.394	59.210	71.603	--	--	--
16 (Average)	2483.500	12.403	23.412	35.815	74.00	54.00	Pass

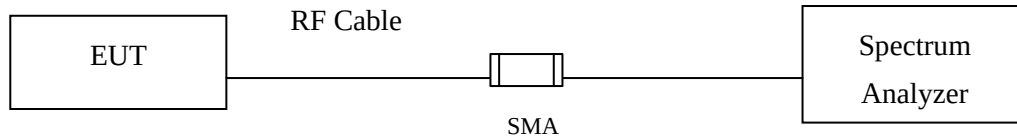
Figure Channel 26: Vertical (Peak)

Figure Channel 26: Vertical (Average)


Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

7. 6dB Bandwidth

7.1. Test Setup



7.2. Limits

The minimum bandwidth shall be at least 500 kHz.

7.3. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 1-5% of the emission bandwidth, $VBW \geq 3 \cdot RBW$

7.4. Uncertainty

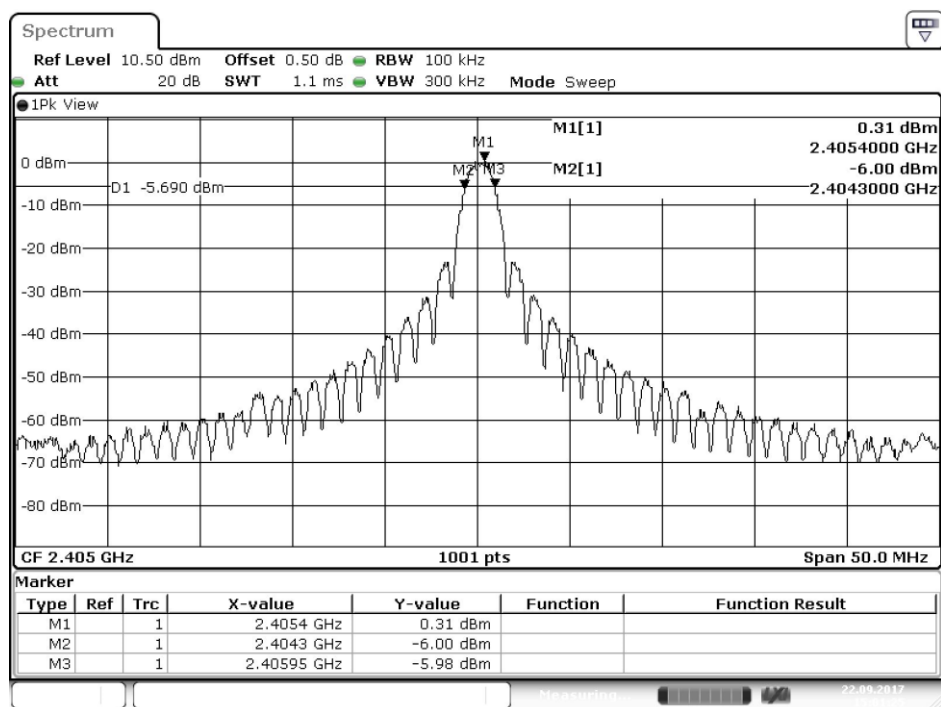
$\pm 279.2\text{Hz}$

7.5. Test Result of 6dB Bandwidth

Product : Logistics Monitoring Tag
 Test Item : 6dB Bandwidth Data
 Test Mode : Mode 1: Transmit (2402MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2405	1650	>500	Pass

Figure Channel 11:

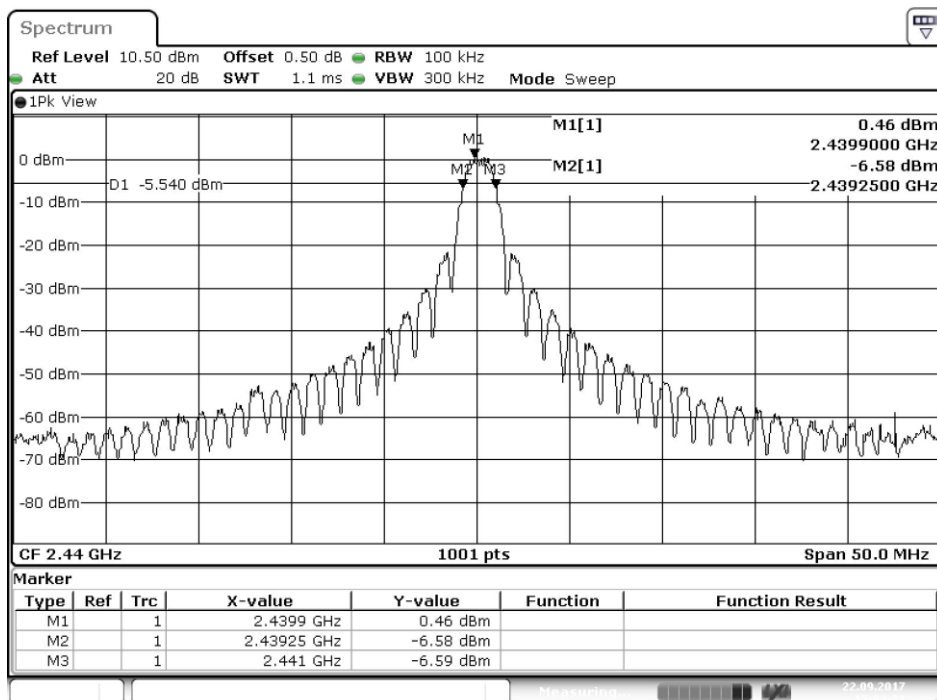


Date: 22.SEP.2017 15:01:25

Product : Logistics Monitoring Tag
 Test Item : 6dB Bandwidth Data
 Test Mode : Mode 1: Transmit (2440MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
08	2440	1750	>500	Pass

Figure Channel 18:

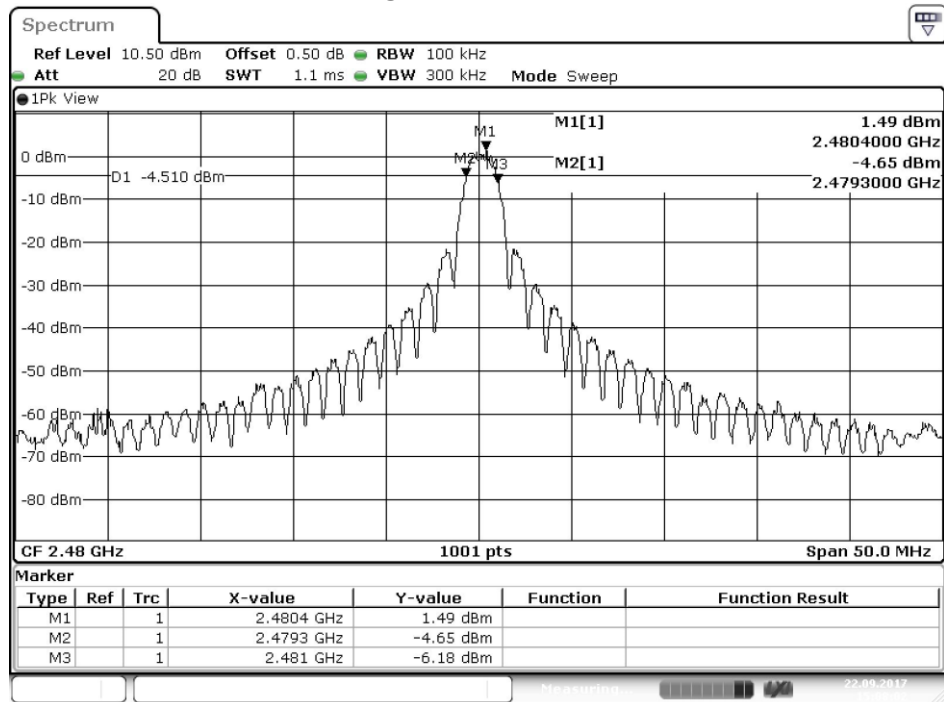


Date: 22.SEP.2017 15:03:21

Product : Logistics Monitoring Tag
 Test Item : 6dB Bandwidth Data
 Test Mode : Mode 1: Transmit (2480MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
16	2480	1700	>500	Pass

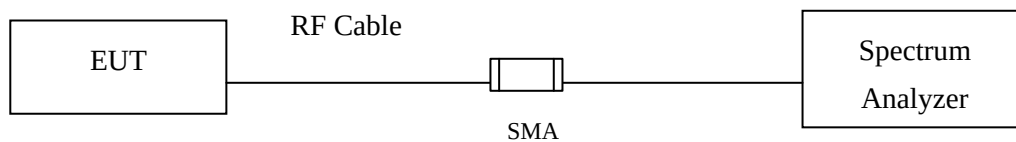
Figure Channel 26:



Date: 22.SEP.2017 15:08:03

8. Power Density

8.1. Test Setup



8.2. Limits

The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3kHz bandwidth.

8.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013, the maximum power spectral density using KDB 558074 section 10.2 PKPSD (peak PSD) method.

8.4. Uncertainty

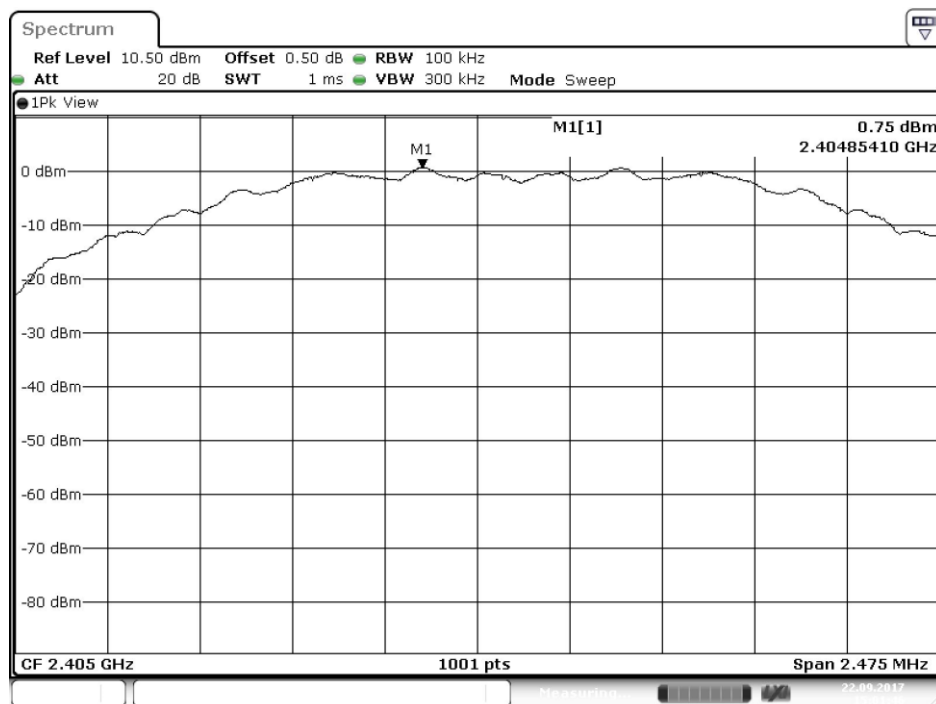
$\pm 1.23\text{dB}$

8.5. Test Result of Power Density

Product : Logistics Monitoring Tag
 Test Item : Power Density Data
 Test Mode : Mode 1: Transmit (2402MHz)

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
01	2405	0.75	$\leq 8\text{dBm}$	Pass

Figure Channel 11:

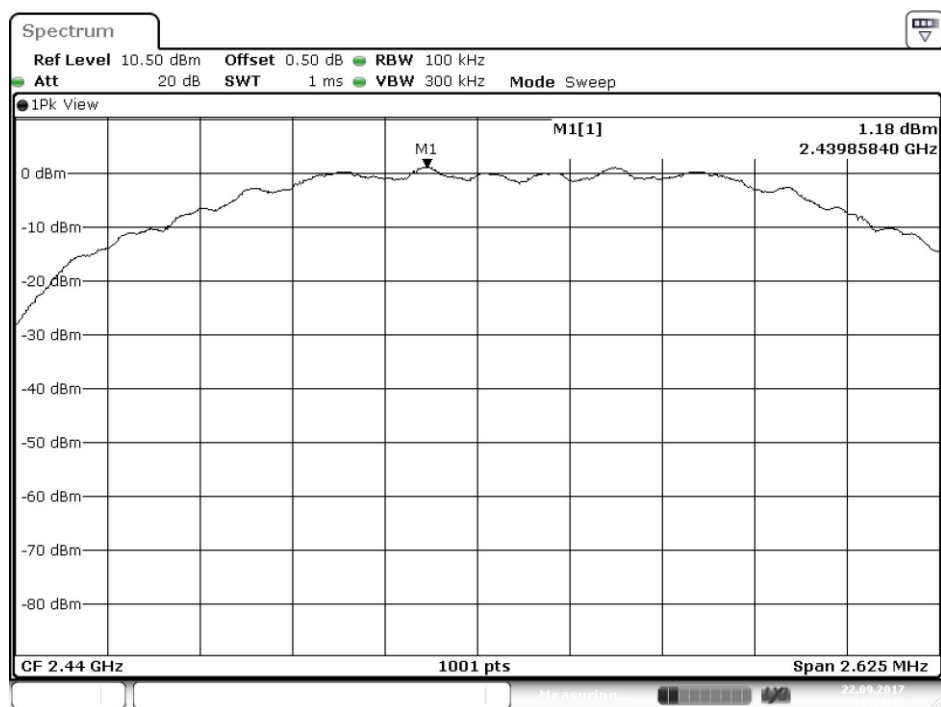


Date: 22.SEP.2017 15:01:47

Product : Logistics Monitoring Tag
 Test Item : Power Density Data
 Test Mode : Mode 1: Transmit (2440MHz)

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
08	2440	1.18	$\leq 8\text{dBm}$	Pass

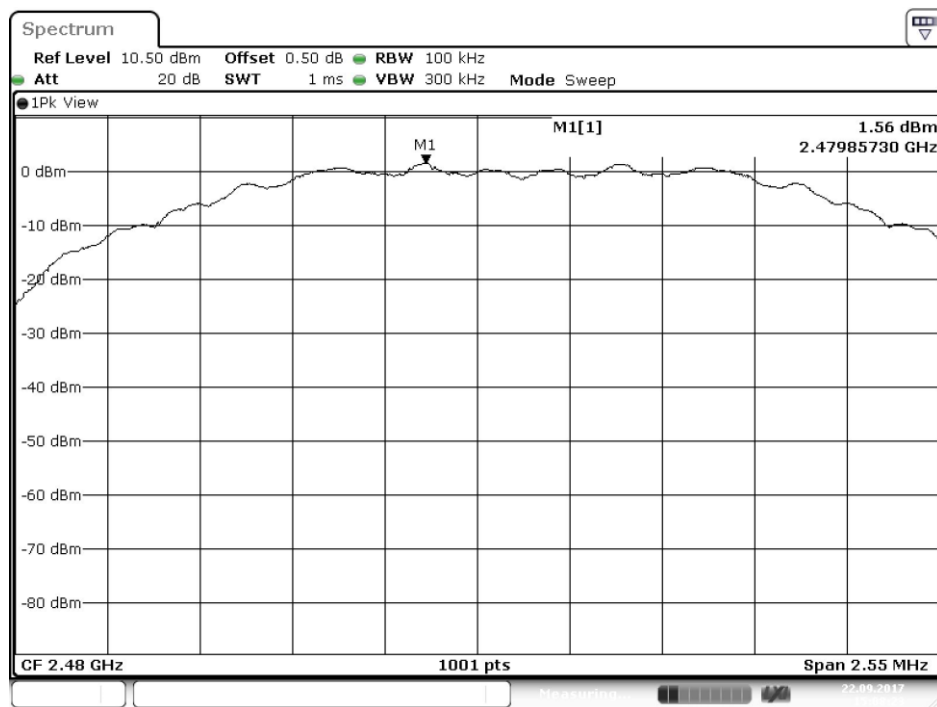
Figure Channel 18:



Product : Logistics Monitoring Tag
 Test Item : Power Density Data
 Test Mode : Mode 1: Transmit (2480MHz)

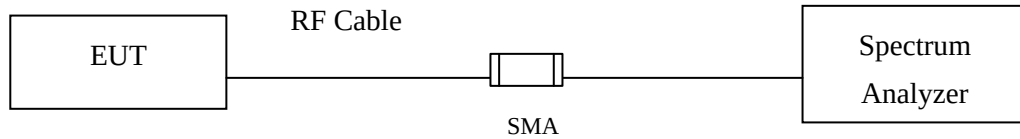
Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
16	2480	1.56	$\leq 8\text{dBm}$	Pass

Figure Channel 26:



9. Duty Cycle

9.1. Test Setup



9.2. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

9.3. Uncertainty

$\pm 2.31\text{msec}$

9.4. Test Result of Duty Cycle

Product : Logistics Monitoring Tag
 Test Item : Duty Cycle
 Test Mode : Mode 1: Transmit

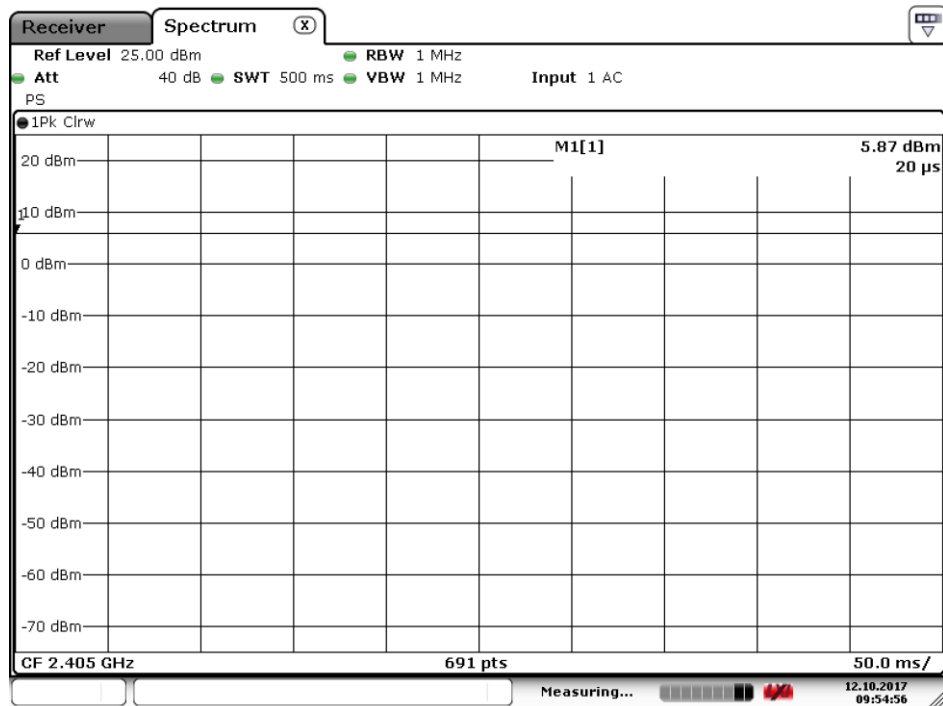
Duty Cycle Formula:

Duty Cycle = Ton / (Ton + Toff)

Duty Factor = 10 Log (1/Duty Cycle)

Results:

2.4GHz band	Ton (ms)	Ton + Toff (ms)	Duty Cycle (%)	Duty Factor (dB)
802.15.4	--	--	100	0



Date: 12.OCT.2017 09:54:57

10. EMI Reduction Method During Compliance Testing

No modification was made during testing.